

HIGHWAYS MANAGEMENT DIVISION
CASUALTY REDUCTION GROUP

ROAD SAFETY AUDIT

AN INVESTIGATION INTO CASUALTY SAVINGS

Discussion Report



SURREY
COUNTY COUNCIL

Highways and Transportation Department
G.M. LAMB, M.Sc., C.Eng., F.I.C.E.
County Director of Highways and Transportation

CONTENTS.

1. Introduction.

1.1 Definition of Road Safety Audit

1.2 Road Safety Audit within Surrey County Council

2. Method

2.1 Purpose of Investigation

2.2 Site Selection

2.3 Comparison of Sites

2.3.1 Accidents per year

2.3.2 Accident rate per Million Vehicles

3. Results

3.1 Accidents per year

3.1.1 Sites not Road Safety Audited

3.1.2 Sites Road Safety Audited

3.2 Accident Rate per Million Vehicles

3.2.1 Sites where Number of Accidents Increased

3.2.2 Sites where Number of Accidents Decreased

4. Concluding Comments

5. References

Appendices

1. INTRODUCTION.

1.1 DEFINITION OF ROAD SAFETY AUDIT.

Road Safety Audit (RSA) is the independent examination of any highway scheme... against known safety standards, whether the scheme be for major or minor improvements, maintenance or development needs. It attempts to identify the causes of potential accidents in the design proposals prior to construction.

Road Safety Audit is a means of accident prevention rather than a cure. However, it is unrealistic to design accident free schemes. Road user behaviour and adverse weather conditions are major contributory factors in accidents. Road Safety Audit ensures that accidents are kept as low as possible from an 'engineering' viewpoint.

The Department of Transport (DoT) and The Institution of Highways and Transportation (IHT) both published guidelines in 1990 for the Safety Audit of Highways.

1.2 ROAD SAFETY AUDIT WITHIN SURREY COUNTY COUNCIL

Road Safety Audit is part of Surrey County Council's wider overall commitment to reduce casualties by 30% by the year 2000.

The RSA procedure takes the form of four stages, with each stage having its own checklist against which the scheme is assessed. The four stages are :-

- Stage 1. Preliminary Design
- Stage 2. Detailed Design
- Stage 3. Pre Construction
- Stage 4. Post Construction

The Safety Audit procedure has been performed on sites constructed from 1990 onwards. Approximately 240 sites have been or are in the process of being Safety Audited.

A computerised database of all RSA sites has been set up using a Windows based Geographic Information System (WINGS). This enables all of the sites to be monitored for accidents. Accident information can be easily retrieved, as the whole of Surrey County Council's accident system is also on a WINGS database.

Further information about this report can be obtained from Sarah Mulligan or Ian Ransom, Casualty Reduction Group, Room 365, County Hall, Kingston Upon Thames, KT1 2DN, telephone 081-541-9964/9985

2. METHOD.

2.1 PURPOSE OF INVESTIGATION

The purpose of the investigation was to determine whether Road Safety Audit produces any additional casualty savings over and above scheme implementation.

An investigation into 19 sites which had been Safety Audited was carried out. The study also involved the comparison of before and after accident statistics with 19 similar remedial measures constructed before the RSA procedure was implemented in Surrey.

2.2 SITE SELECTION

Sites which were selected needed to have a suitable 'after' period. It was felt that sites with a period of at least two years after construction would be adequate.

There was no difficulty in selecting sites which had not been Safety Audited which had such an after period. However, it was not so easy for those sites which had been Safety Audited, as proper procedures had not been introduced until June/July 1991. In order to have a suitable time period it was necessary to include some sites which had not been through all four stages of the RSA procedure.

The sites which had not been Safety Audited were selected from the Minor Works List. These were chosen by the type of measures implemented so that they would be comparable to those schemes which had been through the RSA procedure. The types of measures included junction improvements, pedestrian facilities and right turn lanes.

2.3 COMPARISON OF SITES.

Accident statistics were collected for all 38 sites for a period of at least two years prior to construction and at least two years after. Accidents which had been caused by alcohol/drugs were discounted.

2.3.1 Accidents per year.

An average of accidents per year for before and after construction was calculated.

The yearly averages were then totalled and the mean for all the sites determined. These mean represent the average number of accidents per year per site.

An average of casualties per accident was calculated, for the whole of the County, from the total number of casualties per year divided by the total number of accidents per year.

The average number of casualties per site per year was then determined.

This was done for both sites which had been safety audited and those which had not, and for both periods of before and after construction. The casualty saving per site per year was then found.

2.3.2 Accident rate per million vehicles.

For those sites which had a marked difference in the number of accidents per year before and after construction a further analysis was performed (where the information was available).

The accident rate per million vehicles was calculated using an average 24 hour flow for the site.

3. RESULTS.

3.1 ACCIDENTS PER YEAR

3.1.1 Sites not Road Safety Audited

Summary of details given in table No.1.

- The average number of casualties per accident for the years 1987 - 1989 is 1.314.
- The average number of accidents per site per year prior to construction was 1.98, and after construction was 1.78.
- The average number of casualties per site per year prior to construction is $1.314 \times 1.98 = 2.60$
- The average number of casualties per site per year after construction is $1.314 \times 1.78 = 2.34$
- The average casualty saving per site per year is 0.26.

3.1.2 Sites Road Safety Audited

Summary of details given in table No. 2.

- The average number of casualties per accident for the years 1989 - 1991 is 1.315.
- The average number of accidents per site per year prior to construction was 1.58, and after construction was 0.63.
- The average number of casualties per site per year prior to construction is $1.315 \times 1.58 = 2.08$
- The average number of casualties per site per year after construction is $1.315 \times 0.63 = 0.83$
- The average casualty saving per site per year is 1.25

Summary of Results

	Time Period	Cty Average Cas per acc	Ave Accs per site per year	Ave Cas per site per year	Ave Casualty saving
Not Safety Audited	before	1.314	1.98	2.60	0.26
	after	1.314	1.78	2.34	
Safety Audited	before	1.315	1.58	2.08	1.25
	after	1.315	0.63	0.83	

3.2 Accident Rate per Million Vehicles

The following tables list the results of 12 sites where detailed drawings were available. The appendices provide scheme details and traffic flows.

3.2.1 Sites where number of accidents increased.

The majority of sites where the numbers of accidents increased after construction were those sites which had not been through a RSA.

Site No	Site Name	Acc rate before	Acc rate after
SA16	D1390 Succombs Hill, Warlingham	0.36	0.74
NSA1	B3121 Station Rd j/w Brighton Rd, Addlestone	0.89	0.92
NSA2	B3376 St. Paul's Rd, Egham	0.12	0.27
NSA6	A245 Old Woking Rd j/w Station Approach, Byfleet	0.07	0.24
NSA9	A317 Balfour Rd, Weybridge	0.05	0.11
NSA16	A309 Hampton Court Way j/w Weston Court Rd	0.37	0.62

Table No. 3

3.2.2 Sites where number of accidents decreased.

The majority of sites where the numbers of accidents decreased after construction were those sites which had been through a RSA.

Site No	Site Name	Acc rate before	Acc rate after
SA1	B388 Vicarage Road j/w Wickham Lane, Egham	*	0.52
SA4	A24 London Rd j/w Sparrow Farm Road, Stoneleigh	0.41	0.14
SA15	A22 Caterham Bypass j/w B2030 Godstone Road	1.05	0.38
SA17	A22 Salmons Lane to Wapses Lodge roundabout	0.52	0.38
SA18	A25 East Hill, Oxted	0.90	0.00
NSA8	C153 Molesey Road j/w Rydens Road, Hersham	*	0.25

*traffic flow information unavailable

Table No. 4

ACCIDENTS AT SITES NOT SAFETY AUDITED (1987 - 1988)

NSA No.	SITE NAME	TYPE OF IMPROVEMENT	DATE OF CONSTRUCTION	ACCIDENTS PER YEAR	
				BEFORE	AFTER
1.	B3121 Station Road, Addlestone	Junction Improvement	March 1988	5.3	6.9
2.	B3376 Thorpe Road o/s St. Pauls church	Pelican Crossing	November 1988	0.69	1.44
3.	A244 Upper Halliford Bypass j/w Charlton La	Junction Improvement	July 1988	1.55	0.00
4.	D6242 Downside Sunbury	Footway	September 1988	1.09	1.78
5.	D3512 Knoll Road, Camberley	Pedestrian Refuge	March 1989	0.44	0.36
6.	A245 Old Woking Rd j/w Station App, Byfleet	Signal Modifications	November 1987	0.34	1.92
7.	B374 Heath Rd j/w Brooklands La, Weybrge	Safety Measures	November 1987	0.68	0.96
8.	C153 Molesey Rd j/w Rydens Rd, Hersham	Pedestrian Islands	November 1988	4.11	2.40
9.	A317 Balfour Rd, Weybridge	Roundabout	January 1989	0.48	1.04
10.	B284 Hook Rd j/w Horton La, Epsom	Junction Improvement	April 1988	2.14	1.50
11.	D2041 Bradford Dr j/w Kingston Rd, Ewell	Pedestrian Facilities	November 1988	0.00	0.00
12.	A23 j/w Honeycrock Lane, Salfords	Junction Improvement	December 1988	2.40	2.40
13.	A2022 Fir Tree Road, Banstead	Footway	February 1989	2.00	1.76
14.	B2219 Holly La j/w Garrets La, Banstead	Mini Roundabout	February 1987	0.00	0.00
15.	A24 Dorking Rd o/s hospital, Epsom	Right Turn Facility	January 1986	0.50	1.50
16.	A309 Hampton Crt Way j/w Weston Green Rd	Junction Improvement	September 1987	4.36	4.00
17.	A3046 Chobham Rd j/w Littlewick Rd, Horsell	Junction Improvement	January 1987	5.00	0.00
18.	A3044 Stanwell Moor Rd, Staines	Footway	November 1986	3.65	1.44
19.	D3282 Fairfield Ave j/w High St, Staines	Pedestrian Facilities	September 1987	2.91	4.44
TOTAL				37.64	33.84
AVERAGE				1.98	1.78

NOTES:

Use average of 1.314 casualties per accident.

Average casualty per site per year prior to construction = $1.314 \times 1.98 = 2.60$, and average casualty per site per year after construction = $1.314 \times 1.78 = 2.34$

Casualty saving per site per year = 0.26.

TABLE No. 1

ACCIDENTS AT SITES SAFETY AUDITED (1989 - 1991)

SA No.	SITE NAME	TYPE OF IMPROVEMENT	DATE OF CONSTRUCTION	ACCIDENTS PER YEAR	
				BEFORE	AFTER
1.	B388 Vicarage Rd j/w Wickham La, Egham	Lighting Scheme	January 1990	5.0	1.23
2.	B3407 High St j/w Denham Rd, Egham	Mini roundabout	January 1990	2.5	1.85
3.	A30 London Road j/w Bridge Road, Bagshot	Signal Installation	June 1990	4	2.86
4.	A24 London Rd j/w Sparrow Farm Rd, Ewell	Signal Installation	February 1991	1.85	0.48
5.	D2540 Cleeve Road, Leatherhead	Chicane	February 1991	0.46	0.00
6.	A245 Station Road, Leatherhead	Footway	March 1991	0.00	1.00
7.	A320 Pycroft Road j/w Cowley Ave, Chertsey	Junction Improvement	March 1991	0.89	1.00
8.	A2003 Chalkpit Lane, Dorking	Pedestrian Refuge	April 1991	1.29	0.00
9.	B375 Heriot Road j/w Guildford St, Chertsey	Mini roundabout	May 1991	0.83	0.00
10.	D2537 Church Road, Leatherhead	Footway	July 1991	0.39	0.60
11.	B388 The Avenue j/w Albany Place, Egham	Carriageway Realignment	November 1991	1.03	0.00
12.	A325 West St j/w The Chantryes, Farnham	Right Turn Lane	March 1990	0.44	0.66
13.	B3001 Farnham Road, Elstead	Footway	January 1990	0.00	0.00
14.	C32 Station Lane j/w Rake Lane, Milford	Junction Improvement	January 1990	0.96	0.32
15.	A22 Caterham By-pass j/w B2030 Godstone Rd	Junction Improvement	February 1990	4.62	0.32
16.	D1390 Succombs Hill, Warlingham	Footway	March 1990	0.89	1.67
17.	A22 Salmons Lane to Wapses Lodge rab	Gap Closures	May 1990	2.48	0.92
18.	A25 East Hill, Oxted	Footway	April 1991	2.10	0.00
19.	B2028 Moor Lane, Dormansland	Footway	February 1991	0.32	0.00
TOTAL				30.05	11.91
AVERAGE				1.58	0.63

NOTES:

Use average of 1.315 casualties per accident.

Average casualty per site per year prior to construction = $1.315 \times 1.58 = 2.08$, and average casualty per site per year after construction = $1.315 \times 0.63 = 0.83$

Casualties savings per site per year = 1.25.

TABLE No. 2

4. CONCLUDING COMMENTS

It can be seen from the results that the average casualty saving per site per year is greater for those sites which have been through a RSA. It could be stated that RSA produces a saving over and above scheme implementation of approximately one casualty per site per year.

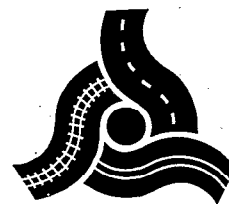
Out of the schemes that had not been through a RSA 21% have had / are planned to have further works. Of those schemes that had been through a RSA 5% (one site) required any further works.

However, it must be noted that only 19 sites were investigated all of which were minor schemes. The sites chosen which were not safety audited were similar only in scheme type - not in accident type, traffic flow, location or cost of measures - to those which had been through a RSA.

This study is the first of several planned to be carried out, hopefully one study a year will be completed.

The sites were chosen at random and hence the numbers of accidents at some locations are small in number.

The results may not be conclusive but they indicate that accident/casualty savings could be achieved through proper Safety Audit.



Contact : Ron Gowan
Telephone : 9854 2645
Date : 11 April 1996

Mr Mike Gadd
2/63 Rountree Street
Christchurch
New Zealand

Dear Mr Gadd

Benefits of Safety Audit

I refer to your letter of 13 March 1996 with regard to possible VicRoads documented evidence quantifying the benefits of road safety audits.

Whilst safety audits of new works have been carried out on many projects, VicRoads has not evaluated the gains this process may have achieved.

The following also needs to be appreciated:

- (i) the safety auditing of new projects provides an overview of a particular stage. It is therefore just one part of the verification process that requires assessment and checking of the project brief, input data and design/construction outcomes (progressive and cumulative).

Quite often, safety deficiencies identified by the safety audit have been appreciated by the designers during the development of the scheme, but in the balance between safety, aesthetics, cost, environmental requirements, functionality, community amenity, etc., the optimum safety standard has been "traded off".

That is, to even only determine whether the safety audit identified a deficiency, the outcomes from the earlier progressive micro checks needs to be known. That is, was the deficiency previously identified.

- (ii) safety auditing is not just about checking compliance with current standards, but also, evaluating a proposed scheme against desirable safety principles and practices.

That is, whilst it is appropriate that the safety audit goes beyond current standards, in the end the planners, designers and project managers must make decisions within "the

possible".

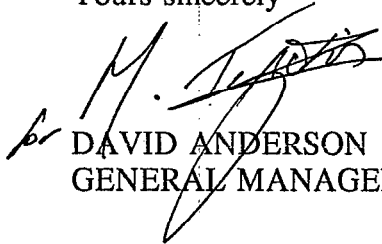
What is therefore identified by the auditors as a deficiency may well be a desirable objective.

- (iii) safety auditing is often a subjective point of view.
- (iv) the safety deficiencies identified through an audit are often difficult to quantify in terms of accident performance.

The measure of safety audit effectiveness therefore needs to be defined.

Whilst as indicated above, VicRoads has not evaluated the effectiveness of safety auditing, it is generally considered that the process has heightened an awareness of road safety practice and made both designers and constructors more conscious of the possible safety performance of their project.

Yours sincerely


DAVID ANDERSON

GENERAL MANAGER ROAD SAFETY



14 May 1996

M. L. Mike Gadd
Civil and Transportation Engineers
2/63 Rountree Street Christchurch 4
New Zealand

Thank you for your letter asking for information on the danish experiences on safety audit and traffic calming.

Her I submit a few words on the work going on in Denmark.

Safety Audit in Denmark:

The idea of Road Safety Audit occured in UK in the late 80-es, and was introduced in Denmark in 1992. The British concept was adjusted to Danish conditions and published in a manual. During a 2 year period the Danish Road Directorate has carried out a pilot project on road safety audit including (13 schemes on) national, regional and municipality roads.

This study has been evaluated by an independent panel of experts.

The results from the evaluation were very clear:

In average the costs have been increased by 1 % but the cost-effectiveness of safety audit is A FIRST YEAR RATE OF RETURN of more than 100 %. - which means that this activity seems to be a very effectsfull tool for Crash Prevention.

It has already been decided to implement Safety Audit as a general routine on all national Roads in Denmark in the future.

All new road schemes on the national Road Network as well as schemes for modifying and improving existing roads are reviewed by independent road safety specialists.

The review is carried out on decided steps during the process from planning over designing to construction.

The intention is to extend the general use of Safety Audit to include all county roads and municipality roads also.

Copenhagen

Islands Gade 13
Box 1569
1220 Copenhagen K
Denmark
phone: +45 33 93 33 38
+45 33 15 63 35

Roskilde

Elisagaardsvej 5
P.O. Box 235
DK-4000 Roskilde
Denmark
Telephone: +45 46 30 01 00
Telefax: +45 46 30 01 05

Skanderborg

Thomas Helsteds Vej 11
P.O. Box 529
DK-8660 Skanderborg
Denmark
Telephone: +45 89 93 22 00
Telefax: +45 86 52 20 13

The basis for a general systematical use of safety Audit is development of a safety effect database. In Denmark a CD-ROM version of such a database will be developed during 1996/97.

Traffic Calming:

I submit two reports about traffic calming in Denmark.

I have great interest in having a short summary information from you about the work on "Traffic safety audit" in New Zealand.

Yours Sincerely



Lene Herrstedt

M. L. (Mike) Gadd C.Eng., MICE, FIPENZ, Registered Engineer.

Civil and Transportation Engineer, 2/63 Rountree Street Christchurch 4 tel/fax (03) 348 - 3710, Mobile 025-376-325

Mr Peter Borough,
Engineering Policy Division,
Room 4/53,
St. Christopher House,
Southwark Street,
LONDON SE1 0TE
ENGLAND

Dear Mr Borough,

BENEFITS OF SAFETY AUDIT

Thank you for replying to my letter to Sophia Lambert.

I am interested in the fact that the TRRL has been commissioned to do research on this topic and - with my clients approval - will be happy to share results and experiences.

While it would probably be rude of me to write to the TRRL direct, since under the present rules you are probably financing the research, I would be grateful for a contact name at some stage, as liaison could be of mutual benefit. For instance, I have already carried out research on the manner of conducting urban safety audits, and the frequency in which topics occur. If Dr Appleton agrees, you might care for a copy of the report (short version) which is about to be published.

Yours sincerely,

M. L. (Mike). Gadd

Engineering Policy Division
Room 4/53
St Christopher House
Southwark Street
London
SE1 0TE

Direct Dial: 0171 921 4362
Fax No: 0171 921 4346
GTN Tel No: 3813 4362

Mike Gadd CEng, MICE, FIPENZ
Civil and Transportation Engineer,
2/63 Rountree Street,
Christchurch 4,
New Zealand.

Our Ref: EPP 18/1/6

Your Ref:

24 April 1996

Dear Mr Gadd

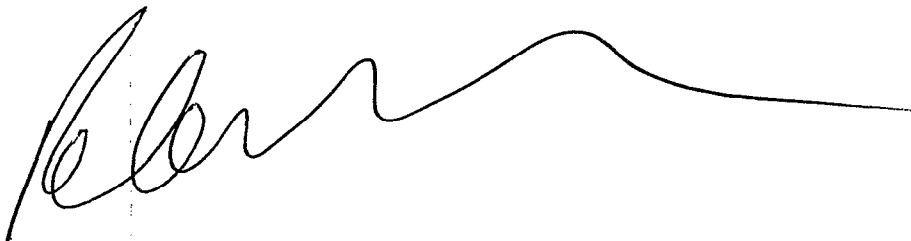
BENEFITS OF SAFETY AUDIT

Your letter to Sophia Lambert at the Department of Transport has been passed to me for reply.

The Highways Agency has recently commissioned the Transport Research Laboratory to undertake research into the benefits that have accrued from the first five years of Trunk Road Safety Audit in England. It is hoped that the research will also enable us to identify best practice.

The results of the research are not yet known but we would be interested in sharing the results with you on a reciprocal basis.

Yours sincerely



Peter Borrough

cc:- M Barnett DOT RS2